ARE SOCIALLY DOMINANT MEN MORE FACIALLY DOMINANT AND MORE PRONE TO SEXUAL JEALOUSY?

by

CHAWKI AHMED BELHADI

Presented to the Faculty of the Graduate School of

The University of Texas at Arlington in Partial Fulfillment

of the Requirements

for the Degree of

MASTER OF SCIENCE IN PSYCHOLOGY

THE UNIVERSITY OF TEXAS AT ARLINGTON

AUGUST 2006

To my wife and friend, Padmini, and Dr. Janet L. Tekell.

ACKNOWLEDGEMENTS

I would like to thank all my committee members: Drs. Roger L. Mellgren, Dan S. Levine, Dave S. Gorfein, and Paul. E. Etcheverry.

July 3, 2006

ABSTRACT

ARE SOCIALLY DOMINANT MEN MORE FACIALLY DOMINANT AND MORE PRONE TO JEALOUSY?

Publication No. _____

Chawki Ahmed Belhadi, M.S.

The University of Texas at Arlington, 2006

Supervising Professor: Roger L. Mellgren

Previous studies show that men with masculine facial characteristics are perceived as more dominant than men with less masculine facial characteristics. This study investigated whether facially dominant men behaved more dominantly and were more prone to sexual jealousy. Participants were 115 males enrolled in UTA introductory psychology classes. Dominant behavior constituted the number of times participants stuck to their position in a series of cooperative decision making trials; sexual jealousy was measured using a modification of Buss et al's. (1992) jealousy scenario, and facial dominance was measured using subjective ratings. Results indicated a significant positive correlation between facial dominance and sexual jealousy but no equivalent correlation between facial dominance and behavioral dominance. Associated findings

revealed significant positive correlations between facial dominance and each of the four variables of trait dominance, height, self-presentation bias, and directional asymmetry. Results were discussed in the context of measurement validity and androgen exposure.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 Background

Infants and children reliably differentiate dominant faces from submissive faces (Gross, 1997; Montepare & Zebrowitz et al. 1989). They differentiate differences in scale as well, i.e. whether one face is more or less dominant than another (Keating & Bai, 1986). Such faces are characterized by children as belonging to people who"....look like they are going to fight the most and get what they want…" (Keating & Bai, 1986).

Adults too can differentiate dominant faces and, like infants and children, they also attribute dominant personality characteristics to them (Berry, 1990; Berry, 1991; Cherulnik, Way, Ames, & Hutto, 1981; Cunningham, Barbee, & Pike, 1990). This ability to differentiate dominant faces is culturally universal since people from different cultures distinguish dominant faces, and do so reliably (Keating et al. 1981; Keating, Mazur, & Segall, 1981).

Facial dominance ratings are also valid. Men and women rated as facially dominant[1] tend to achieve high levels of dominance or status (Cherulnik, Turns, & Wilderman, 1990; Mazur, Mazur, & Keating, 1984). Facially dominant individuals further appear more "fit". Facially dominant military officers father more offspring to

[1] Facial dominance as judged from static facial appearance, i.e. frontal view facial pictures with clothing & jewelry out of view or controlled. Facial dominance judged from full body shots or naturalistic interactions, or from photos or videos of such, introduce the possibility of confounds, i.e. setting, physical height and build, clothing, movement, behavioral cues etc.

the age of sexual maturity than their facially subdominant counterparts (Mueller & Mazur, 1997). The same holds true for African Kung San Bushmen. Men with more dominant faces and more body size are reproductively more successful (Winkler & Kirchengast, 1994).

That stated, by necessity the achievement of dominance and fitness has to implicate behavior. One cannot exert dominance, nor establish one's fitness, unless one interacts with conspecifics. The implicated behavior in this context is ostensibly dominant behavior.

1.1.1 Facial dominance as a predictor of behavioral dominance

Behavioral dominance is behavior that "…aims at achieving and maintaining high status [dominance] and greater control of resources over a conspecific…" (Mueller & Mazur, 1997). If indirect measures of dominant behavior are used such as measures of trait-dominance and/or traits that implicate trait-dominance, (e.g. social potency, assertiveness, aggression, and power), then, yes, facial dominance does appear to predict dominant behavior (Berry & Brownlow, 1989; Berry, 1990; Berry, 1991; Cherulnik et al. 1990).

Further, from evidence linking the development of facial dominance (A) with testosterone exposure (B) (Grammer & Thornhill, 1994; Penton-Voak & Chen, 2004; Thornhill & Gangestad, 1996), and evidence linking testosterone exposure (B) with behavioral dominance (C) (Mazur & Booth, 1998), one can transitively arrive at the facial dominance-behavioral dominance link (A→B and B→C, A → C) (Mazur & Booth, 1998; Mueller & Mazur, 1997).

Other points of evidence have been cited to support the link between facial dominance and behavioral dominance. They include the cross-cultural reliability of facial dominance ratings (Keating, Mazur, & Segall, 1981; Keating et al. 1981) and the plausibility of a neural basis for the perception of facial dominance (Blair, 2003; Morris et al. 1996; Posamentier & Abdi, 2003). Honest Signaling Theory (HST) is also mentioned (Grafen & Johnstone, 1993; Smith, 1994). HST maintains that the "honesty" of a "signal" such as facial dominance can be evolutionary stable provided the signal is costly AND the marginal fitness costs of signaling are higher for individuals of low phenotypic quality[2].

In any case, a basis at least is established for a link between facial dominance and the potential for dominant behavior. There is in addition the implied argument of an evolved behavioral module, one governing the perception of facial dominance, and the regulation of its behavioral responses (Mueller & Mazur, 1997).

Be that as it may, these efforts do not attempt to measure behavioral dominance directly, whether through behavior counts of non-verbal or verbal behaviors (e.g., Burgoon, Buller, Hale, & Deturck, 1984; Cherulnik et al. 1981; Lamb, 1981; Mast & Hall, 2004), coding of message sequences in social interactions (e.g., Rogers & Farace, 1975) or through quantification of outcomes, e.g. winning zero-sum games (Mazur & Cataldo, 1989). There have however been studies that have investigated the relationship between dominant behavior and dominance perception from full body appearance (Kalma, 1991; Mast & Hall, 2004). These studies have all indicated that "full body

[2] Evidence does in fact corroborate this point (Grafen & Johnstone, 1993; Smith, 1994).

dominance" predicts the magnitude of dominant behavior expression. No study to date though has examined the [3]facial dominance-dominant behavior relationship using a DIRECT BEHAVIORAL MEASURE. I propose a direct evidentiary standard therefore, one designed to further define the facial dominance-behavioral dominance relationship.

1.1.2 Dominance and the human face

Almost all studied species of primates including humans use facial expressions to signal dominance (Weisfeld & Beresford, 1982). In Keating et al. (1981), raters judged a group of models as more dominant when their brows were lowered than when they were raised. Smiling or not smiling also impacted the perception of dominance. Non-smiling models are judged as more dominant than smiling models. Mazur and Mueller (1996) accordingly classify eyebrow position and smiling as *controllable* signs of dominance.

Facial dominance by contrast is a *constant* sign of dominance. It originates from fixed aspects of the face, e.g. the brow ridges, jaw, and cheekbones, and is the degree to which a person is *perceived* from the face to be *dominant*, assertive and a leader, as contrasted against someone who is submissive, unassertive, and a follower (Mueller & Mazur, 1997).

Perceptually, facial dominance is a gestalt. Square jaws, heavy brow ridges, broad cheekbones, and protrusion of the face's center form the perception (Thornhill & Gangestad, 1996). Facial submissiveness, on the other hand, consists of a round face with large eyes, smallish nose, and high eyebrows (Mueller & Mazur, 1997). Though

[3] As measured by static facial appearance

facial dominance is found in both sexes, it is not equally distributed. Men are markedly more facially dominant than women. Like body size, facial dominance is a sexually dimorphic characteristic.

Facial dominance is thought to derive from the interaction between testosterone and human development. High levels of testosterone pre- and peri-natally organize the brain and body along masculine lines (Mazur & Booth, 1998). Part of that organization involves the distribution of androgen receptors. Later around puberty, a high ratio of testosterone to estrogen activates these receptors. The result is the development of secondary masculine sexual characteristics including the lateral growth of the jaw, chin, and brow ridge etc., features all implicated in facial dominance (Thornhill & Gangestad, 1996).

1.1.3 The facial dominance finding

The "discovery" of facial dominance was serendipitous (Keating, Mazur, & Segall, 1977; Keating, Mazur, & Segall, 1981). In a cross cultural study looking at controllable facial signs, Keating et al. (1977) found that, independent of their expression, certain faces were consistently rated as dominant. Coupled with data from infants and toddlers showing they reliably differentiate dominant faces from submissive faces (Gross, 1997; Montepare & Zebrowitz-McArthur, 1989) this suggested that the perception of facial dominance was universal.

Spurred by the finding, Mazur et al. (1984) went on to examine facial dominance from the context of status attainment. They looked at graduation portraits from the West Point Class of 1950 and found that, in their junior and senior years,

dominant-looking cadets were promoted to significantly higher ranks than subdominant cadets. The effect however did not extend into mid career (after the candidates had left West Point).

Speculation as to why centered on the following:

1. Lack of correspondence between facial dominance early and later in life, i.e. facial dominance was not a stable characteristic
2. Facial dominance was thought to be relevant only in the context of face-to-face contact. In other words, it did not matter that the promotion board had updated photographs. Without in person contact, the pictures were immaterial.
3. Facial dominance is a function of the rank of the cadet and is not an inherent quality. Facial dominance is thus not a constant sign but a changeable one, one that is, at least with regards to rank, a function of self-perception
4. Promotions in mid-career are not so much dependent on the candidate's appearance but on his qualifications.

In any case, as a follow up Mazur and colleagues mailed questionnaires to members of the 1950 class. Examining those data revealed something unexpected. Dominant facial appearance was still unrelated to ranks at mid-career. Mueller and Mazur (1996) however found a relationship with promotions in late career, a full 15 years after the graduation portraits were taken.

In effect, when physical appearance was reintroduced into the promotions process, facial dominance again became a factor. Though this was the case only when the 'qualifications' variable was controlled. When it came to possible promotions to the

rank of general, this was effectively the case. The qualifications of candidates for promotions to the rank of general were more or less equivalent. This did not apply in the case of promotions into the lower ranks. In those instances, qualifications tended to vary considerably, enough that facial dominance was no longer a significant factor. In effect, reason #4 won out.

Contrary to previous thinking, facial dominance proved stable later in life, when men typically peak in status attainment.

1.1.4 Definitions

Status simply means one's *dominance* or standing in the social order. I distinguish between two types of dominance*, social dominance* and *vested dominance* (Burgoon et al. 1998). The focus here is on *social dominance.*

Social dominance[4] is status "…acquired through demonstrated abilities, [social] strategies, or potential for affiliation". It manifests through such "...indicators as proximity, posture, gaze, facial expression [and appearance], vocalizations, duration of talk, or language use*"* (Burgoon et al. 1998). This contrasts with *vested dominance*, which refers to status acquired through such fixed characteristics as heritability and kinship, e.g. the status of a hereditary sovereign like a king or queen (Burgoon et al. 1998). Vested dominance therefore is not necessarily earned. Social dominance however, is earned and, by definition, encompasses dominant behavior.

[4] Social dominance hereafter will be referred to as *dominance.*

1.2 Lines of Evidence

1.2.1 Facial dominance as a biological signal

A "signal" is defined in biology as either an action or physical structure that increases the fitness of the signaling organism (Johnstone & Grafen, 1993). Fitness is increased by an induced change in the behavior of the "receiver". Any change in the behavior of the receiver constitutes the "response" to the "signal". An "honest signal" is simply one that conveys accurate information. As with any signal-response cycle, the signaler can "choose" to convey honest information or not and the receiver, accordingly, can "choose" to believe whether the information is honest or not.

Honest Signaling theory proposes that signals will be reliably honest, provided: 1) the signal is costly, and 2) the marginal fitness cost of the signal is higher for individuals of "lower" quality (Johnstone, 1995).

As detailed earlier, a high testosterone-to-estrogen ratio mediates the development of facial dominance. Facial dominance could be said in effect to "mark" testosterone exposure. A noted by-product of the exposure is the suppression of the immune system, i.e. a decrease in disease resistance (Folstad & Karter, 1992). This suppression constitutes a cost or "handicap". Individuals that can afford the handicap, and the production cost of facial dominance itself, tend to be individuals of higher phenotypic quality (Thornhill & Gangestad, 1996).

Sexual selection seems to bear this out. Prominent physical features tend to positively correlate with high status, e.g. height, athletic physique, and attractiveness (Mueller & Mazur, 1997). A dominant facial appearance thus, to a woman, may

constitute evidence that an individual has passed "a test" (Bergstrom, 2002). This may explain why women prefer facially dominant men during periods of peak fertility (Penton-Voak et al. 2003), or why during that time they prefer other dominant traits in men like a masculine voice (Feinberg et al. 2006) or "dominant" body odor (Havlicek, Roberts, & Flegr, 2005). A woman, who is able to discriminate a man with dominant qualities from one without, has an advantage in the mating market. She is able to pick out high quality mates from the lower quality mates

In addition to the handicap itself, harmful reactions from competitors or rivals are also costly (Guilford & Dawkins, 1995). Signals, whether costly or not, are predicated on the idea they convey accurate or "honest" information. It would not be an evolutionary stable strategy (ESS) for signal receivers to observe a particular signal unless it was *on average* accurate. If a signal *on average* was not accurate then receivers, e.g. competitors and rivals, would have evolved to ignore it (Bergstrom, 2002). The signal being essentially worthless, the signalers would have evolved not to send them.

The existence of the signal implies that both the signaler and the receiver *on average* benefit from it. Mathematical modeling in fact corroborates this (Johnstone & Grafen, 1992; Johnstone & Grafen, 1993; Penton-Voak et al. 2003). What insures the "honesty" and stability of the signal is the fitness cost to the dishonest signaler (Moller, 1987; Rohwer & Rohwer, 1978; Roskaft & Rohwer, 1987).

1.2.2 Phylogenetic evidence

In house sparrows, brown chest spots are a sign of dominance. Painting dominant chest spots on a sub-dominant house sparrow provokes aggressive attacks from dominant birds (Moller, 1987). The attacks are significantly more aggressive than attacks on unpainted sub-dominant sparrows. The suggestion is that dominant birds detect an inconsistency between the signal and the condition of the painted birds. Giving painted sub-dominant birds injections of testosterone corroborates that conclusion. Dominant birds cease engaging sub-dominant birds after a series of "challenge" attacks.

This logic appears to hold in humans. Using competence as an index of condition, Mueller and Mazur (1997) demonstrated that if facially dominant men did not meet minimum standards of competence they did not benefit from being facially dominant and they actually fared worse than comparably qualified men who were not facially dominant. The advantage conferred by facial dominance is contingent upon meeting a minimum standard. As in the case of the house sparrow, the suggestion is that when an inconsistency is detected between the signal and the condition of the signaler, a significant cost is imposed. So as a subdominant animal, if "you" signal that you are dominant you are more likely to be "tested" and, by extension, have any "phony" dominance revealed.

This cost in effect constitutes a selection pressure against dishonest signalers. Dishonest signalers in essence fare worse than non-signalers of comparable condition. Conversely, honest signalers fare better than non-signalers of comparable condition.

That stated, the signaling equilibrium is not a perfect one. Though the equilibrium holds in "noisy" environments, model analysis reveals that some cheating is possible (Grafen & Johnstone, 1993). The cheating however does not destabilize the greater equilibrium (Adams & Mestertongibbons, 1995).

1.2.3 Physiological evidence

Imaging evidence suggests that certain brain structures like the amygdala, the superior temporal sulcus, and the lateral fusiform gyrus may be involved in facial perception (Blair, 2003; Posamentier & Abdi, 2003). They apparently activate in response to the identification of faces, facial expressions, and facial features. These structures are involved in processing information gleamed from the face and are also implicated in the regulation of reciprocal behaviors. The possibility exists that the perception of facial dominance may be similarly localized in the brain. In conjunction with the reliability of facial dominance ratings, this suggests that the perception of -and the reaction to- facial dominance may be hard-wired (Mueller & Mazur, 1997).

As stated before, facial dominance can be thought of as a testosterone marker. Coupled with findings indicating a link between high levels of circulating testosterone and dominant behavior (Mazur & Booth, 1998), the suggestion is that facial dominance and the potential for behavioral dominance are related. A positive relationship between levels of salivary testosterone and dominant facial appearance in men only support the connection (Penton-Voak & Chen, 2004).

As it relates to circulating testosterone however, findings are mixed. Neave et al. (2003) could not find a relationship between circulating testosterone and facial

dominance, nor could Koehler et al. (2004). Neave (2003) however did find a relationship between facial dominance and a value known as 2D:4D.

2D:4D is simply the ratio of the lengths of the second and fourth manual digits. Like facial dominance, it is a sexually dimorphic trait[5] with men having a significantly lower ratio than women (Manning et al. 1998). Men tend to have fourth digits longer than the second (2D:4D $\leq$ 1). In women, the ratio is closer to 1 with both digits tending to be of equal length (2D:4D $\geq$ 1) (Manning et al. 1998). The dimorphism expresses early in life. It has been measured in individuals as young as two years of age (Manning et al. 1998).

The sex difference appears to express in utero, at around the 13th or 14th week of gestation (Manning et al. 1998). Essentially, prenatal testosterone is thought to induce greater growth of the fourth manual digit relative to the second (Manning et al. 1998). Evidence for this view comes from studies of individuals with congenital adrenal hyperplasia (CAH), a disorder in which the fetus is exposed to abnormally high levels of testosterone. Men and women with this condition tend to exhibit lower 2D:4D's than matched controls (Brown, Hines, Fane, & Breedlove, 2002; Okten, Kalyoncu, & Yaris, 2002).

Because of the relationship between 2D:4D and prenatal androgens, 2D:4D -like facial dominance- is characterized as a somatic marker of prenatal testosterone levels. If this characterization is valid then 2D:4D should negatively correlate with physical characteristics that are also mediated by prenatal androgens. This in fact is supported by

Neave et al. (2003) who found that facial dominance and 2D:4D negatively correlated in men. That is, the higher the facial dominance rating the lower or male-typical the 2D:4D ratio.

1.2.4 Psychological evidence

Seven studies have coupled static measures of dominance[6] with measures of dominant behavior (Berry & Brownlow, 1989; Berry, 1990; Berry, 1991; Cherulnik et al. 1981; Cherulnik et al. 1990; Kalma, 1991; Mast & Hall, 2004). All seven studies found a positive correlation between dominant appearance and dominant behavior. From this group however, only one study employed a direct measure of dominant behavior (Kalma, 1991), and only four were even trying to measure facial dominance in the first place (Berry & Brownlow, 1989; Berry, 1990; Berry, 1991; Cherulnik et al. 1990) leaving a total of three to evaluate dominance from full body appearance (Cherulnik et al. 1981; Kalma, 1991; Mast & Hall, 2004).

All the same, none of the studies cited measured dominant behavior directly AND employed frontal view facial pictures. The frontal view facial shot, or static facial appearance standard, is preferable for it avoids the issue of confounds. Incorporating the body below the neck, and/or introducing a video account or live interaction, raises the possibility of confounds like setting, physical height and build, clothing, movement, behavioral cues etc. Moreover, non-frontal view facial shots do not give a full enough account of the face. In any case, studies that used static facial appearance and indirect

[5] 2D:4D is also laterally dimorphic. Of the two hands, the right tends to have a lower 2D:4D than the left (Manning et al., 1998). This is attributed to the action of prenatal androgens which, purportedly, affect the right side more than the left (Brown et al., 2002).

measures of dominant behavior all found positive correlations (Berry & Brownlow, 1989; Berry, 1990; Berry, 1991; Cherulnik et al. 1981; Cherulnik et al. 1990). They all however only used trait or behavior potential measures of dominant behavior.

Kalma (1991) found that "first glance impressions" of dominance predicted dominant behavior[7]. A "first glance impression" consists of two people standing face to face for what, ostensibly, is a few seconds (the author does not specify). Of all the studies cited, this study comes closest to paralleling the premise of the present research. However, as discussed before confounds are associated with dominance judgments obtained from measures other than static facial appearance. The present research only uses static facial appearance.

1.3 Study Objectives

1.3.1 Background and purpose

This study was designed to investigate the relationship between *facial dominance* and *behavioral dominance*. Unlike previous studies however, this study used a direct behavioral measure of dominance, one called the Standard Experimental Setting or SES (Berger, Fisek, & Conner, 1974). SES quantifies outcomes from "win/loss" encounters[8].

The study also tried to replicate the negative relationship between 2D:4D and facial dominance, and explored the possibility of a link between 2D:4D and behavioral dominance. Facial and behavioral dominance were also each examined against trait

[6] As measured from either full body appearance or the face.
[7] Operationalized as the amount of subsequent talking in same sex triads and dyads

dominance. Sexual jealousy was examined as well against each of the variables of facial dominance, behavioral dominance, and trait dominance.

The incorporation of the sexual jealousy measure stemmed from its possible relationship with behavioral dominance. Belhadi and Mellgren (2004) found that given a hypothetical infidelity scenario, high "net" dominance[9] scores predicted sexual infidelity as the type of infidelity participants preferred to be informed of first. What follows is a definition and explanation of sexual jealousy.

1.3.2 Sexual Jealousy[10]: a primer

Please think of a committed romantic relationship that you have had in the past, that you have now, or that you would like to have. You now suspect that the person with whom you have been seriously involved is spending time with someone else. If your partner is in fact involved with that person, what would upset or distress you more?[11]

(Please check only one option.)

__(A) Imagining your partner forming a deep emotional attachment to that person
__(B) Imagining your partner having sex with that person

If you are man, your answer is likely to be (b). If you are a woman, your answer is likely to be (a) (Buss, 2000). The pattern of responses observed is sexually dimorphic, with men being more upset by sexual infidelity, and women being more

---

[8] SES was conceived originally as a measure of social influence but was later adapted to measure behavioral dominance. See Mazur & Cataldo (1989).

[9] The BSRI "net" dominance score is defined as the Student's t ratio for the difference between a person's dominance and nurturance subscale scores. It is the difference between an individual's dominance and nurturance subscale scores normalized with respect to the standard deviations of his dominance and nurturance subscale scores. "Net" dominance is analogous to the androgyny score of the BSRI (Bem, 1974). Instead of indexing masculinity, high positive scores index dominance. Conversely, high negative scores index nurturance.

[10] Jealousy is described as an emotional "state that is aroused by a perceived threat to a valued relationship or position and motivates behavior aimed at countering the threat…" (Daly, Wilson, & Weghorst, 1982).

[11] Buss, Larsen, Westen, & Semmelroth, 1992

upset by emotional infidelity. Evidence from this measure[12] is often cited in support of the view that there are sex differences in jealousy (Harris, 2003). The account cited in support of this view is JSIM, the Jealousy as a Specific Innate Module hypothesis (Harris, 2000).

Sex differences in jealousy are attributed in JSIM to the different selective pressures that existed in the ancestral environment. These selection pressures are thought to have shaped the evolution of sex specific behavioral modules[13].

JSIM hypothesizes that men get more upset over a mate's sexual infidelity. This is thought to stem from the problem of paternal uncertainty. Because fertilization occurs internally in the woman, men, unlike women, never know with absolute certainty whether their offspring are their own. Cuckoldry is therefore a real problem. Not only can men lose a chance at reproduction, they also risk investing resources in a rival's offspring.

Sexual jealousy in theory motivates behavior that defends *against* cuckoldry. Indifference to cuckoldry, in theory, does not. The result is that men who were indifferent to cuckoldry likely experienced lower paternal certainty, greater investment in a rival's DNA, and lower reproductive success overall (Buss et al., 1992). Accordingly, selection pressures in the ancestral environment presumably "favored" men who were NOT indifferent to sexual infidelity

[12] The forced choice method (Buss et al., 1992)

[13] A behavioral module is a set of hard-wired brain circuits that guide our emotional reactions to relationship threats (Harris, 2004). Behavioral modules are characterized as automatic mental processes that are activated reflexively (Buss & Kenrick, 1998). They are thought to activate in response to specific situational triggers that in turn "…produce specific cognitive, physiological, emotional, and/or behavioral output through specialized algorithms and/or decision rules"(Buss & Kenrick, 1998).

For a woman, emotional infidelity risked the loss of a mate's investment in her offspring. Unlike men, women have total parental certainty. Cuckoldry therefore is not a problem. A loss of resource investment however is a potential problem (Buss et al., 1992). It may result in a loss of resource investment from her mate which can result in lower survival rates for offspring and ultimately lower rates of reproduction. Similar to men, the result is that women who were indifferent to emotional infidelity likely experienced a loss of investment in their own DNA, and ultimately lower reproductive success. Accordingly, in the case of women, selection pressures in the ancestral environment presumably "favored" women who were NOT indifferent to emotional infidelity

1.3.3 Sexual jealousy and dominant behavior

Morbid jealousy is a conviction, often delusional, that one's mate is cheating or having an affair (Harris, 2004). Patients with the condition are often depressed and anxious, and tend to stalk their mates (Harris, 2004). This stalking behavior can be viewed as an extension of mate guarding. The morbidly jealous man is in effect consolidating access to a "reproductive resource" by preventing, as it were, other men from "tapping" it. Stalking may as a result act to safeguard fitness by insuring that cuckoldry does not occur. Stalking and possessive behavior may thus be an extension of dominant behavior. Dominant behavior aims at insuring "… greater control of resources over a conspecific…" (Mueller & Mazur, 1997). Stalking appears to do the same.

1.3.4 Sexual jealousy and facial dominance

Findings by Pratto and Hegarty (2000) reveal that social dominance orientation[14] (SDO) in men is strongly related to the expectation of extramarital affairs, resistance for caring for children as one's own, and sexual jealousy. Sidanius and Pratto (2001) attribute the action of androgens as underlying why men show higher levels of SDO than women[15], and why men are more socially hierarchical & more aggressive. Given that facial dominance has been linked to both circulating testosterone levels (Penton-Voak & Chen, 2004; Swaddle & Reierson, 2002) and prenatal androgen levels (Neave et al., 2003), a basis is proposed here for the link between sexual jealousy and facial dominance.

1.3.5 Height and facial dominance

Like facial dominance, evidence shows that height also involves the action of androgens. Gonadal and adrenal androgens play a role in regulating the rate and growth in height from mid-childhood to late adolescence when human beings reach their adult height (Zemel & Katz, 1986). Androgens are not the only hormones implicated however. Somatotropin and human growth hormone (HGH) also play a part but this is beside the point. What is of import is that androgens exert a measure of control over height just as they do with facial dominance. Height will therefore be examined in this context. Given that both height and facial dominance appear to be mediated by androgens, the prediction is that height and facial dominance will positively correlate.

[14] Social dominance orientation is simply "the degree to which individuals desire and support group-based hierarchy and the domination of 'inferior' groups by 'superior' groups" (Sidanius & Pratto, 2001).
[15] Like facial dominance, SDO is sexually dimorphic.

1.3.6 Ray's Dominance Scale Questionnaire

Ray's Dominance Questionnaire (RDQ) is a scale that measures trait dominance (Ray, 1981). It was used to determine the possibility of convergence with the behavioral dominance measure (SES), and the possibility of a relationship between sexual jealousy and trait dominance.

1.3.7 The Balanced Inventory of Desirable Responding (BIDR)

The Balanced Inventory of Desirable Responding (BIDR) (Paulhus, 1988) was used to control for any self-presentation bias in the trait and behavioral dominance measures. The BIDR measures two constructs: self-deceptive positivity and impression management. Self-deceptive positivity refers to the tendency to give honest but positively biased answers. Impression management refers to the tendency to deliberately bias how one presents to an audience.

1.3.8 Facial attractiveness ratings

Facial attractiveness ratings were collected to clarify the relationship between facial dominance and facial attractiveness. The relationship in the literature is presently unclear. A pair of studies has found a female preference for masculine faces (Johnston et al. 2001; Keating, 1985) while another pair has not (Penton-Voak et al. 1999; Perrett et al. 1998). Other studies by contrast have been equivocal (Cunningham et al.1990, Jones & Hill, 1993, Swaddle & Rierson, 2002).

1.4 Hypotheses

Hypothesis 1

Facial dominance will positively correlate with behavioral dominance.

Hypothesis 2

Facial dominance will positively correlate with trait dominance measure.

Hypothesis 3

Facial dominance will negatively correlate with 2D:4D

Hypothesis 4

Facial dominance will positively correlate with sexual jealousy.

Hypothesis 5

Behavioral dominance will positively correlate with sexual jealousy.

Hypothesis 6

Behavioral dominance will positively correlate with trait dominance.

Hypothesis 7

Trait dominance will positively correlate with sexual jealousy.

Hypothesis 8

Facial dominance will positively correlate with height.

CHAPTER 2

METHODS

2.1 Phase I & II

2.1.1 Participants

The participants were 115 male undergraduates[16] enrolled in UTA introductory psychology classes (*M* = 20.54 yrs; *SD* = 2.57; range = 17 – 27 yrs). All participants received credit towards a research participation requirement. Of the 120 original participants, five were dropped because of age[17]

2.1.2 Materials

2.1.2.1 Digital camera.

A digital camera was used to photograph participants' faces.

2.1.2.2 Flat bed scanner

An Epson Perfection 3490 PHOTO scanner was used to scan participants' hands.

2.1.2.3 Imaging Software

The scan was converted into a photo image (*.jpg) using Adobe® Photoshop® Elements 2.0.

[16] The sample included 75 Whites, 8 African-Americans, 11 Hispanics, and 25 Asians.

[17] Age-wise, they were positive outliers. All things being equal, increased age is associated with higher status and, by extension, higher levels of dominance (Sidanius & Pratto, 2001). Increased age may thus confound the measure of dominance within the default population (undergraduates enrolled in introductory psychology classes) because individuals over 35 are more the exception than the rule.

2.1.2.4 GNU image manipulation program

The GNU Image Manipulation Program (GIMP) v. 2.2.6 (Free Software Foundation, 2005) was used to measure digit lengths. Using the GIMP measure tool, the total pixel length of each 2nd and 4th digit (spanning the middle of the basal crease to the tip of the digit) was measured using the photo image.

2.1.2.5 Measuring tape

A 15' measuring tape was used to measure height. The tape was parallel to and abutted the juncture between two perpendicular walls.

2.1.2.6 SES computer program

The Standard Experimental Setting computer program (SES v7.2) was used to measure behavioral dominance (Troyer, 2002). SES quantifies outcomes from "win/loss" or "hold/cede" encounters. SES presses participants to either hold or cede their position in a series of cooperative decision making trials. Participants are deceived into thinking they are engaged in a cooperative decision task with a "fellow participant". In reality, they are interacting with the computer running the procedure.

Illustration of the SES Program:

The SES protocol starts by instructing subjects that they are participating in a study that is designed to test a "newly discovered skill" ("Contrast Sensitivity Ability"). They are advised that the skill may be related to the spacing of the eyes, and to the anatomical symmetry of the hand but not to such known abilities as mathematical

competence or artistic ability[18]. The participant is then asked to work on the "Contrast Sensitivity" task along with a "partner" *(a "partner" the participant does not know to be fictional).* The subject is told that the "partner", a fellow undergraduate, is at "another university" *(Note: Effectively, "the "partner" is out of the subject's sight).* Following the instruction, the participant is directed to operate the SES computer program. The program contains multiple frames, each containing two black and white rectangular arrays. The subject is asked to choose the pattern in each pair that has the greater white area. *(The frames are standardized so as to make the choice of either pattern equally likely).* After the subject makes an initial choice, he is then "informed" of his "partner's choice" *(the "partner's" choice is determined by SES).* Following that information, the participant is then asked to make a second and final choice. Eighty percent of the time *(20 of 25 trials)*, the "partner's choice" is simply the opposite of the participant's[19]. Being that the task is "collaborative", the subject will be put into multiple situations where their final choice conflicts with their "partner's". The number of trials where the subject cedes their position relative to the number of total "active" trials constitutes the measure of behavioral dominance.

Background Description

SES has some precedence as a measure of dominance (Mazur & Cataldo, 1989). Win/loss measures like this one however have received some criticism in the literature. Burgoon, Johnson, and Koch (1998) have described such measures as ignoring "…the situational, relational, and dynamic nature of dominance." In its defense however, SES

[18] This constitutes the "cover story".

holds situation constant between subjects and across trials. Further it has built-in options which control for the social characteristics of participants (the relational aspect). It arranges for each participant to play against a completely identical pseudo-partner, identical in terms of gender and academic classification[20]. Given the participant does not see the" partner", SES also controls for status and dominance cues, i.e. physical size, age, mode of dress etc.

In addition to controlling for status, SES controls for "one's level of Contrast Sensitivity Ability (CSA)". After an initial "training phase" where participants become acclimated to the task, participants are given feedback about their CSA. "Both" participants received feedback that they were of average ability. This effectively controlled for CSA. Average ability was assigned on the assumption that extreme levels, because they constitute a more definite indication of ability, would be interpreted by the participant as meaning that their "partner" was "more dominant". Average CSA ability was defined as scores between 10 and 15 on a scale of 0-25. The participant and "partner" scores used here were 11 and 13. A stricter control would have been to report identical scores for both "participants". That however, as noted by Foschi (1996), would likely have created suspicion thus the 11--13 score pair was the one chosen[21].

PC's were used to administer the SES computer program to participants. The PC's fulfilled the following hardware and system requirements (Troyer, 2002):

1. Pentium 166 or higher

---

[19] Such trials are called "active trials"
[20] If need be, the "participants" can be matched up on other attributes like ethnicity, age, height, weight etc.
[21] Note: the sequence within the score pair was counterbalanced across participants

2. Windows ’95 or higher

3. Apple *QuickTime* installed®

4. Video Resolution 800 x 600 or higher

5. 32 Mb RAM or higher

6. Hard Drive 1Gb or higher

2.1.2.7 Trait dominance measure

Ray’s Dominance Questionnaire (RDQ) is a self-report measure of trait dominance (Ray, 1981). It was used here because of its significant positive correlation with peer-rated dominance (Heaven, 1986). It contains 30 statements about behaviors, preferences, thoughts, and feelings. Participants simply rate how accurately each statement describes them. The rating scale contains 3 response options: Yes = 1, Not sure = 2, or No = 3. Trait dominance was simply the total score obtained on the instrument. The alpha coefficient for the sample was .81.

2.1.2.8 Measure of self-presentation bias

The Balanced Inventory of Desirable Responding or BIDR consists of 40 items. Items 1-20 comprise the Self-Deceptive Positivity Scale, and items 21-40 comprise the Impression Management Scale. Respondents rate their agreement with items on a scale from 1 (not true) to 7 (very true). The inventory was dichotomously scored. Only extreme answers (6 or 7 for positively keyed items and 1 or 2 for negatively scored items) were scored, with one point going to each answer (Paulhus, 1988). The alpha coefficient for the present sample was .78. Respectively, the self-deception (SDE) and impression management (IM) subscales had alpha coefficients of .61 and .73.

2.1.2.9 Jealousy Measure

The measure is a modified version of Buss et al. (1992) hypothetical infidelity scenario. Participants were asked to indicate which type of infidelity upset them the most: sexual infidelity, emotional infidelity, or both equally[22].

2.1.3 Procedure

After providing informed consent, participants reported their name, age, and handedness on a log sheet. Ethnicity was recorded by the experimenter (either 1 = White, 2 = African-American, 3 = Hispanic, or 4 = Asian).

The first phase of the procedure consisted of collecting the following data:

1. The participant's height
2. A digital photograph of the face
   - A color digital image of each participant was taken at high resolution under standard lighting conditions from a distance of 2 feet (level with the nose of the participant). The shot was a frontal one and included the head from the hairline down to just below the jaw margin. The participant was instructed to remove any facial adornments and to assume a neutral expression.
3. The average 2nd to 4th digit ratio of each hand
   - The participant's hands were scanned palms down using the photo scanner. Participants' index (2D) and ring (4D) fingers were measured using the GNU Image Manipulation Program (GIMP). Each digit was measured twice from the ventral proximal crease up to the tip of the finger. 2D:4D ratios

were calculated by dividing the length, in pixels, of the second manual digit (index finger) by the length in pixels, of the fourth manual digit (ring finger) for both hands. The two ratios for each pair of measurements were then averaged. The repeatability of the 2D:4D measurements was high for both the right (2D: $r_1 = 0.96$, 4D: $r_1 = 0.97$, 2D:4D: $r_1 = 0.81$) and left hand (2D: $r_1 = 0.96$, 4D: $r_1 = 0.97$, 2D:4D: $r_1 = 0.87$).

The second phase of the procedure consisted of having the participant operate the SES program. The participant was also instructed to complete the following:

1. The BIDR or the *Balanced Inventory of Desirable Responding*.
2. Ray's Dominance questionnaire (RDQ)
3. The hypothetical infidelity scenario.

Following the procedure, the participant was given a written debriefing statement and questions, if any, were answered.

2.2 Phase III

2.2.1 Participants

Participants were drawn from undergraduates enrolled in upper division UTA psychology classes[23]. Forty raters were recruited (20 women and 20 men; M = 24.98 yrs; *SD*. = 5.58; range = 18 – 42 yrs). Extra credit was granted by agreement with the class instructor.

---

[22] The first two answer options within scenario were counterbalanced across subject

[23] Drawing subjects from a different "pool" was done to limit the likelihood that raters would recognize the identity of the subjects being rated.

2.2.2 Materials

2.2.2.1 Phase I participant photos

Photos of 103 participants were used. In order to achieve a more "muted" look, the original color images were converted into black & white. Of the 115 eligible participants from Phase I, ten were dropped because of significant facial hair, and two were dropped because they did not believe the deceptions used in Phase I. Each picture was cropped so that the inner hairline and face outline were visible but all or most of the hair was covered. This was done to focus attention on the face and away from the hair and surrounding clothing.

2.2.2.2 Anchor point photos

To provide anchors for facial dominance ratings, three representative photos were used from the Mueller and Mazur (1996) study. The photos exemplified a range of facial dominance scores.

2.2.3 Procedure

After first obtaining informed consent, participants wee seated in front a PC and oriented to the task. Given that facial attractiveness is a more "common" judgment, participants rated that dimension first.

2.2.3.1 Facial attractiveness ratings

Raters independently rated subject faces on a seven-point scale of attractiveness (1 = very attractive, 4 = neutral, 7 = very unattractive)[24]. Faces were randomly presented in one of 4 random orders using a *Microsoft PowerPoint*® presentation. Each

photo remained on screen for 7 seconds. Each of the 4 consecutive rating segments consisted of 25-35 faces after which a short break of 1 minute was given. At the end of the rating session, raters were asked if they recognized any of the faces viewed. Scores from recognized faces were eliminated from the data set. The mean score of each face was taken as the measure of facial attractiveness. Interrater Reliability (Cronbach's Coefficient Alpha) for the sample was .97.

2.2.3.2 Facial dominance ratings

Raters then independently rated subject faces on a seven-point scale of dominance-submissiveness (1 = very dominant, 4 = neutral, 7 = very submissive) [24]. Raters were instructed that a dominant person tells other people what to do, is respected, influential, and often a leader; while submissive or subordinate people are not influential or assertive and are usually directed by others. Faces were presented using a *Microsoft PowerPoint*® presentation in one of 4 random orders. Each photo remained on screen for 7 seconds. Each of the 4 consecutive rating segments consisted of 25-35 faces after which a short break of 1 minute was given. Before the rating session, raters were presented with the three anchor point photos from Mueller and Mazur (1996). At the end of the rating session, raters were asked if they recognized any of the faces viewed. Scores from recognized faces were eliminated from the data set. The mean score of each face was taken as the measure of facial dominance. Interrater Reliability

[24] Given that -/+ scales were more typical of the literature, ratings were later reverse scaled.

(Cronbach's Coefficient Alpha) for the sample was .88 (*Note: Facial dominance ratings did not differ significantly across 'sex of rater' (t (204) = 1.873, p = .062).*

CHAPTER 3

RESULTS[25]

3.1 Hypotheses

Pearson correlations were calculated analyzing the relationships predicted in the hypotheses[26]. Results are shown in the Tables 3.1 and 3.2. Descriptive statistics are also provided.

Table 3.1 Correlations I

		RDQ[27] (Trait Dominance)	SES[28] (Behavioral Dominance)	Sexual Infidelity Option [29]	Emotional Infidelity Option[29]	Both options as equally distressing[29]
Facial Dominance	**Pearson Correlation**	***.264(**)***	-.070	***.273(**)***	-.080	-.133
	Sig. (2-tailed)	***.008***	.485	***.009***	.453	.213
	N	***100****	101*	***90****	90*	90*
RDQ (Trait Dominance)	**Pearson Correlation**		.030	-.139	.150	-.039
	Sig. (2-tailed)		.757	.175	.141	.703
	N		108*	97*	97*	97*
SES (Behavioral Dominance)	**Pearson Correlation**			-.113	.185	-.089
	Sig. (2-tailed)			.274	.073	.389
	N			95*	95*	95*
	Mean	69.88	.606	.18	.36	.46
	SD	9.31	.165	.382	.483	.501

* Because of missing data, the number of cases for each correlation ranged from 90 to 115.
** $p < 0.01$ level (2-tailed).

[25] Kolmogorov-Smirnov tests for all interval variables revealed no significant deviations from normality.
[26] Using the SPSS® statistical package
[27] Ray's Dominance Questionnaire
[28] Standard Experimental Setting
[29] Answer option from the jealousy scenario

3.1.1 Hypothesis 1

Hypothesis 1 was not supported. No significant positive correlation was observed between facial dominance (M = 3.55; SD = .70) and behavioral dominance (M = .606; SD = .165). Instead, the results of the analysis showed a marginal negative correlation, one that was not significant (r = -.070, p = .485).

3.1.2 Hypothesis 2

The analysis revealed a significant positive correlation between RDQ (M = 69.88; SD = 9.31) and facial dominance (r = .264, p = .008), a finding consistent with the hypothesis, i.e. the higher the facial dominance rating the higher the trait dominance score. The relationship remained significant even after controlling for self-presentation bias (r = .242, p = .022).

3.1.3 Hypothesis 3

There was indeed an association between 2D:4D (RH: M = .952; SD = .033; LH: M = .950; SD = .033) and facial dominance but it was in the "wrong" direction. That is, in lieu of 2D:4D being negatively associated with facial dominance -which was what was predicted- there was a positive correlation. The relationship was significant only for RH 2D:4D (r = .201, p = .041), see Table 3.2 (next page).

Table 3.2 Correlations II

		LH 2D:4D	RH 2D:4D
Facial Dominance	**Pearson Correlation**	.141	***.201(*)***
	Sig. (2-tailed)	.155	***.041***
	N	103 #	***103*** #
LH 2D:4D	**Pearson Correlation**		***.656 (**)***
	Sig. (2-tailed)		***.000***
	N		***113*** #
	Mean	.950	.952
	SD	.033	.033

** $p < 0.01$ level (2-tailed).
* $p < 0.05$ level (2-tailed).
# Because of missing data, the number of cases for each correlation ranged from 90 to 115.

3.1.4 Hypothesis 4

Hypothesis 4 was supported. The relationship between facial dominance and sexual jealousy[30] was weakly positive though significant ($r = .273$, $p = .009$) [*Note: The sexual infidelity option, as a categorical variable, was dummy coded: Sexual infidelity = 1; 'Emotional Infidelity' or 'Both equally' = 0].* The more facially dominant the participant the more likely sexual infidelity was chosen as the most distressing option. Accordingly, the mean facial dominance rating of participants picking the sexual infidelity option *(M = 3.93, SD = .700)* was significantly higher (*t (90)* = 2.663*, p* = .009*)* than the mean facial dominance rating of participants picking either of the other two options *(M = 3.42, SD = .695).*

The correlations between facial dominance and (the choice of) each of the other two infidelity options were not significant, and only marginally negative: 'Emotional Infidelity' ($r = -.080$, $p = .453$); 'Both equally' ($r = -.133$, $p = .213$), see Table 3.1 *[Note*

Both being categorical variables,' the 'Emotional Infidelity' and 'Both equally' options were dummy coded:' Emotional Infidelity'= 1; 'Sexual Infidelity' or 'Both equally'= 0. And conversely, 'Both equally'= 1; 'Emotional Infidelity' or 'Sexual Infidelity'= 0].

3.1.4.1 Supplemental Analysis

A one-way ANOVA was performed to analyze the facial dominance-sexual jealousy relationship. However, instead of consolidating the FD ratings of respondents picking the emotional *or* 'both equally' infidelity options, each infidelity option was treated as a separate group.

As implied by the preceding analyses, facial dominance was associated with the infidelity option chosen, $F(2, 87) = 3.52$, $p = .034$. Pairwise comparisons were made with Fisher's LSD procedure, holding family-wise error at ≤ .05. See Figure 3.1, next page (*Note: Means sharing a letter in their bars were not significantly different from each other according to the Fisher LSD test*[31]*).* As shown in Figure 3.1, the sexual infidelity option was associated with a significantly better mean facial dominance rating than either the emotional or 'both equally' infidelity options. All other comparisons fell short of statistical significance.

[30] "Sexual jealousy" is defined as the choice of sexual infidelity as the (infidelity) option the participant finds most distressing.
[31] At an alpha level of .05

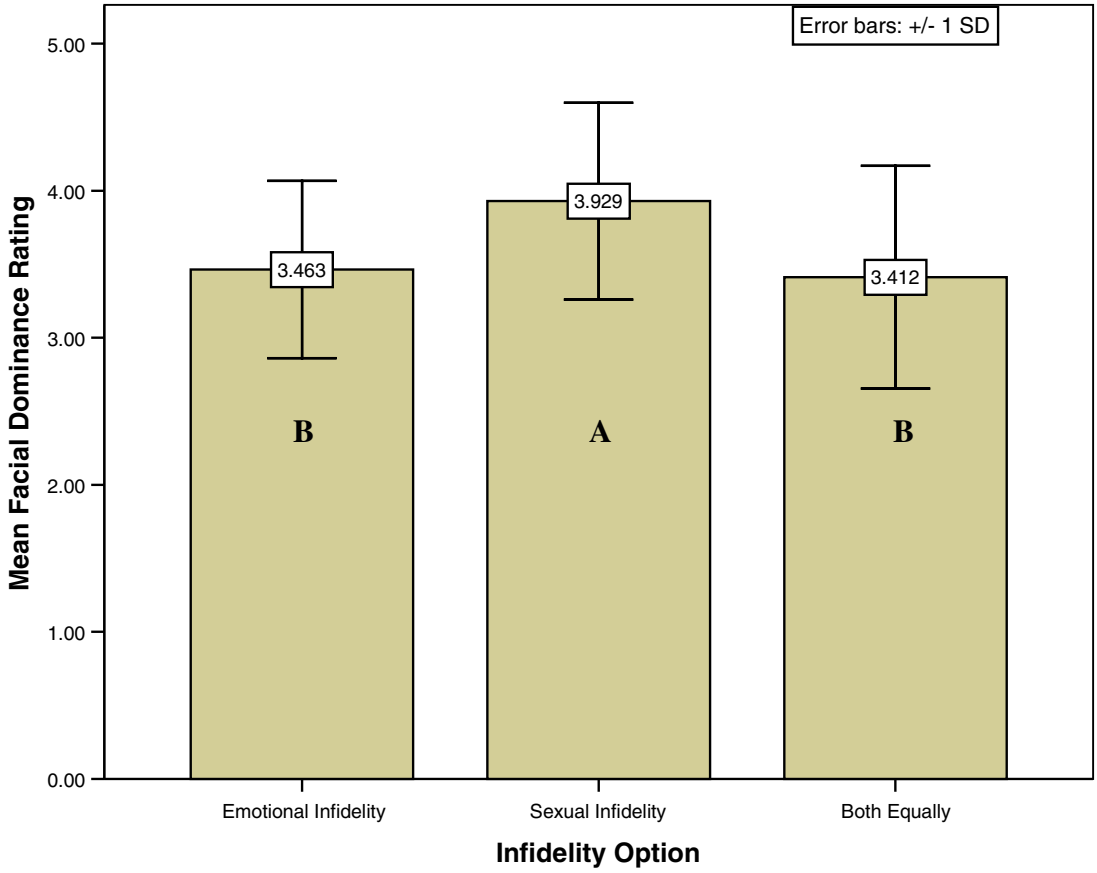

Figure 3.1 Infidelity option on mean facial dominance rating

3.1.4.2 Binary Logistic Regression

A binary logistic regression was performed to determine the extent of the sexual jealousy - facial dominance relationship[32].

For each unit increase in facial dominance the odds of picking the sexual infidelity option increased by 195%. This slope relationship was significant *(Wald Statistic -* $\chi^2 = 5.746$*, df = 1,* $p = .017$), and by extension, the regression model

[32] Using the SPSS® statistical package

was as well (χ^2 = 6.548, *df* =*1*, *p* = .011). It accounted however for only 7% of the variance in the sexual jealousy variable[33].

3.1.4.3 Multiple Linear Regression

A multiple regression analysis was performed to develop an optimum model[34] for predicting facial dominance. The model began with the complete variable set plus all possible cross-product terms. Using a data-driven procedure, the model was reduced by discarding a single variable at a time. The variables, the dropping of which did not appreciable reduce R^2, were discarded from the model. This continued until the optimum model was derived.

The optimum model included the following variables: *sexual jealousy, height*, *RDQ, African-American, Height*African-American and Height*RDQ*[35]. Basic descriptive statistics and regression coefficients are shown in Table 3.3, as are all the possible zero-order correlations. The six predictor model was able to account for 31% of the variance in the facial dominance variable, $F(6, 83) = 7.64$, $p < .001$.

[33] Given the Cox & Snell R^2
[34] The interval variable predictors were all mean-centered to minimize collinearity.
[35] Cross-product interaction terms

Table 3.3 Multiple Regression Model

Variable	Zero-Order *r*						β	*sr*	*b*
	RDQ	**African-American[#]**	**Height**	**Height *RDQ**	**Height* African-American**	**Facial Dominance**			
Height* African-American						*.239***	*.173*	*.147*	*.153*
Height *RDQ					*.030*	*.170*	*.249***	*.237*	*.006***
Height				*-.086*	*.206**	*.258***	*.044**	*.179*	*.192**
African-American			*.043*	*-.014*	*.195**	*.284***	*.554**	*.208*	*.214**
RDQ		*.152*	*.294***	*-.299***	*.078*	*.264***	*.021***	*.256*	*.284***
Sexual infidelity Option[#]	*-.139*	*-.024*	*-.109*	*.061*	*-.077*	*.273***	*.611****	*.330*	*335****
Mean	69.88	.08	69.53	4864.23	4.91	3.55	Intercept = 3.347		
SD	9.31	.270	3.02	729.02	17.97	.70	R^2 =	*.309****	

*** $p < 0.001$ level (2-tailed) ** $p < 0.01$ level (2-tailed) * $p < 0.05$ level (2-tailed) [#] Dummy coded

Save for Height*RDQ which was only marginally significant, each of the predictor variables had a significant zero-order correlation with facial dominance, and all -save for Height*African American- had significant partial effects in the model. The standardized partial slope and partial correlation between sexual jealousy and facial dominance were especially notable. Both had the same sign and were larger in magnitude than the zero order correlation *r*. *A suppressed relationship is therefore likely between facial dominance and sexual jealousy.* The zero-order correlation, in effect, underestimates the facial dominance-sexual jealousy relationship.

3.1.5 Hypothesis 5

The relationship between behavioral dominance and sexual jealousy was weakly negative and did not reach significance (r = -.113, p = .274). The relationship further was not in the expected direction. That is, the more behaviorally dominant the

participant the *less likely* sexual infidelity was judged as the most distressing infidelity option. Hypothesis 5 was therefore not supported.

3.1.6 Hypothesis 6

The hypothesis was not confirmed. RDQ was only marginally related to behavioral dominance *(*r = .030*,* p = .757). Though the relationship was in the anticipated direction, it did not reach significance.

3.1.7 Hypothesis 7

The correlation between *RDQ* and sexual jealousy was weakly negative and did not reach significance (r = -.139, p = .175). The prediction that trait dominance would positively correlate with sexual jealousy was not supported.

3.1.8 Hypothesis 8

Correlational analysis revealed a weak, but significant positive correlation between facial dominance and height (r = .258, p = .009). See Table 3.4, next page.

3.2 Associated Findings

3.2.1 Height

A significant positive correlation was observed between height (M = 69.55; SD = 2.98) and directional asymmetry[36] (r = .229, p = .016). The taller the participant the more masculinized his RH 2D:4D was relative to his LH 2D:4D. Height was also positively correlated with BIDR scores (M = 11.09; SD = 5.25), RDQ scores, and

[36] DA is simply LH 2D:4D – RH 2D:4D. It expresses how lateralized one is with respect to 2D:4D. Positive values of DA are consistent with the male typical pattern, i.e. a lower 2D:4D on the right hand than the left. Negative values of DA in turn are male atypical (Benderlioglu & Nelson, 2004).

Directional Asymmetry (*M* = .001466; *SD* = .028 (see table below). Correlations were all significant.

Table 3.4 Correlation III

		Height	BIDR	RDQ (Trait Dominance)	Directional Asymmetry (DA)
Facial Dominance	**Pearson Correlation**	***.258(**)***	.136		.070
	Sig. (2-tailed)	***.009***	.198		.483
	N	***101#***	91#		103#
Height	**Pearson Correlation**		***.247(*)***	***.294(**)***	***.229(*)***
	Sig. (2-tailed)		***.013***	***.002***	***.016***
	N		***100#***	***110#***	***111#***
BIDR	**Pearson Correlation**			***.221(*)***	-.062
	Sig. (2-tailed)			***.029***	.545
	N			***98#***	98#

** p <0.01 level (2-tailed).
* p < 0.05 level (2-tailed).
# Because of missing data, the number of cases for each correlation ranged from 90 to 115.

3.2.2 Facial attractiveness

Facial attractiveness (*M* = 3.28; *SD* = .60) was significantly negatively correlated with age *(r* = -.346*, p* < .001). It however was not significantly correlated with facial dominance *(r* = .076, *p* = .448*).* This finding is in keeping with the equivocal state of the literature (Gangestad & Scheyd, 2005).

CHAPTER 4

DISCUSSION

The purpose of the study was two-fold: 1) to evaluate the relationship between facial dominance and behavioral dominance; and 2) to explore the possible link between sexual jealousy and each of the three factors of facial dominance, behavioral dominance, and trait dominance.

The study also tried to replicate the relationship between 2D:4D and facial dominance, and explored whether 2D:4D correlated with behavioral dominance. Facial and behavioral dominance were also each examined against trait dominance.

4.1 Hypotheses

4.1.1 Hypothesis 1

Hypothesis #1 was not supported. The lack of a significant positive correlation between facial and behavioral dominance may be related to the use of the SES measure. Though conceptually sound, SES has not been compared with other measures of behavioral dominance. Outside of Mazur and Cataldo (1989), no precedence has been established for its use as a behavioral dominance measure. The reason for its use here centered on its self-administration and efficiency.

Using multiple convergent measures might have yielded a more valid measurement of behavioral dominance. Possibilities include the Behavior-based instrument (Burgoon et al, 1998), which is a peer-rated instrument, or measures of

specific nonverbal and verbal behaviors (Dovidio & Ellyson, 1982), like scoring the relative percentages of looking while speaking and looking while listening. Doing so would perhaps have put the hypothesis in a better position to be assessed, especially in light of all the evidence supporting facial dominance as an "honest" signal.

4.1.2 Hypothesis 2

A significant positive correlation was observed between facial dominance (FD) and the trait dominance measure (RDQ), a finding consistent with the literature (e.g. Berry, 1990; Berry, 1991; Berry & Brownlow, 1989; Cherulnik et al. 1990), i.e. facial dominance is known to correlate with trait dominance measures, and ones that implicate trait-dominance, e.g. social potency, assertiveness, aggression, and power.

4.1.3 Hypothesis 3

Consistent with Koehler et al. (2004), a negative correlation between facial dominance and 2D:4D was not found. Instead both studies showed a positive correlation[37]. A positive correlation is not consistent with the "prenatal androgen hypothesis". This finding puts into question the association between 2D:4D and facial dominance. Given they both appear to be mediated by prenatal androgen levels, the two qualities in theory should negatively correlate. The evidence however, aside from Neave et al.'s (2003) original finding, does not appear to support the link. As noted by Koehler et al. (2004), 2D:4D may not correlate with characteristics like facial dominance which depend additionally on post-natal androgen exposure to express.

[37] However only the finding in the present study was significant.

4.1.4 Hypothesis 4

The prediction that facial dominance and sexual jealousy would be positively correlated was supported. Moreover, the FD ratings of respondents picking the sexual infidelity option was significantly different from the FD ratings of the respondents picking the emotional infidelity option, and the FD ratings of the respondents picking the 'both equally' answer option.

Multiple regression analysis further revealed that the relationship between sexual jealousy and facial dominance was "suppressed". Due to the higher magnitude partial correlation, the zero-order correlation between sexual jealousy and facial dominance underestimated the sexual jealousy-facial dominance relationship.

The relationship between facial dominance and sexual jealousy runs parallel with findings showing a link between social dominance orientation (SDO) and sexual jealousy. As mentioned in the introduction, Pratto and Hegarty (2000) found that SDO in men was strongly related to the expectation of extramarital affairs, resistance for caring for children as one's own, and sexual jealousy. The current finding also runs parallel with unpublished findings by Belhadi and Mellgren (2004) showing that given a hypothetical infidelity scenario, high "net" dominance[38] scores predicted sexual infidelity as the type of infidelity participants preferred to be informed of first.

[38] The BSRI "net" dominance score is defined as the Student's t ratio for the difference between a person's dominance and nurturance subscale scores. It is the difference between an individual's dominance and nurturance subscale scores normalized with respect to the standard deviations of his dominance and nurturance subscale scores. "Net" dominance is analogous to the androgyny score of the BSRI (Bem, 1974). Instead of indexing masculinity, high positive scores index dominance. Conversely, high negative scores index nurturance.

It is probably worth noting that Pratto and Hegarty (2000) used three sexual jealousy measures, all of them "indirect". The measures consisted of asking a total of three questions which if answered appropriately all *implied* sexual jealousy. They consisted of gauging one's refusal to grant a divorce in the instance of an extramarital affair, the indication of the likelihood that their partner would engage in an extramarital affair, and how faithful they expected their partner to be. These and other measures of sexual jealousy (e.g., psychophysiological responses to a sexual infidelity scenario, and emotion rating scales (Pietrzak, Laird, Stevens, & Thompson, 2002)), could be used to further define the relationship between facial dominance and sexual jealousy.

4.1.4.1 The Case of Morbid Jealousy

Morbidly jealous men[39] often act in "proprietary" ways towards their wives or girlfriends. They tend to control their partner's contact with friends and family and often insist on monitoring their whereabouts (Buss, 2000). The behavior may be an attempt to safeguard fitness by limiting the probability of cuckoldry. Effectively, the woman or girlfriend becomes controlled or "managed" just like any other resource. In a social sense, these men are acting "dominantly". They are acting to insure exclusive access to a resource, and do so by "[mate] guarding" it. Dominant behavior implicates aggressive behavior according to Mazur and Booth (1998). So characterizing the behavior of morbidly jealous men as dominant is not altogether unreasonable. If morbid jealousy is in fact an extreme example of sexual jealousy then a logical question, given

[39] Morbid jealousy as it regards men is essentially morbid *sexual* jealousy

the sexual jealousy-facial dominance finding, is whether morbidly jealous men are more facially dominant than their non-morbid counterparts.

As of this writing, the "answer" is not known. The only study to have examined the question is one by Krill and Platek (2006). They found that men convicted of sexual battery expressed low degrees of facial dominance[40] relative to men convicted of non-sexual battery. As of 6/25/06 however, Krill and Platek (2006) have yet to measure the facial dominance of the men convicted of non-sexual battery, the type of violence more typical of morbidly jealous men (Platek, 2006)[41].

All the same, another logical question here is whether SDO is related to facial dominance. This is also not known. A common basis may exist however because, as noted earlier, androgens appear to mediate both conditions. Sidanius and Pratto (2001) cite the action of androgens as the basis for why men show higher levels of SDO than women[42]. Given the purported link between both facial dominance & prenatal androgen levels (Neave et al., 2003) and facial dominance & circulating testosterone levels (Penton-Voak & Chen, 2004; Swaddle & Reierson, 2002), a basis is affirmed here for the study of the SDO-facial dominance association. That stated, an open question related to the current finding is whether sexual jealousy is related to testosterone level.

Findings by Gaulin et al. (1997) certainly imply the possibility. Gaulin and colleagues found that estradiol in women positively correlated with emotional jealousy. Women showed more distress to a partner's emotionality infidelity during the first half

[40] As measured objectively by Scion® image analysis software

[41] Morbidly jealous men do not, as a rule, have to resort to forced copulations with their partners. They typically perpetrate violence that is non-sexual in nature, e.g. physical beatings (Buss, 2000).

of the menstrual cycle (the period where estradiol levels rise) than during menstruation. This finding however could not be replicated by Geary et al. (2001). Given that testosterone is more predominant in men, it would seem reasonable to theorize a similar association between testosterone and sexual jealousy. No studies however –to the author's knowledge- have examined the question. The only applicable study is one involving another primate, the macaque.

Rilling, Winslow, and Kilts (2004) found that, relative to a control group, dominant male macaques put into a "challenge" condition -where they witnessed a potential sexual interaction between their female consort and a rival male- showed larger increases in plasma testosterone, and showed more aggression and greater activation in the central gray matter of the midbrain (an area rich in androgen receptors). The result suggests that a similar mechanism might be operating in human males. This seems especially possible given the transitive association one can draw between sexual jealousy and testosterone: From the supposition linking sexual jealousy (A) with dominant behavior (B), and evidence linking dominant behavior (B) with testosterone exposure (C) (Mazur & Booth, 1998), one can transitively arrive at the sexual jealousy-testosterone link (A→B and B→C, A → C).

4.1.5 Hypothesis 5 & 6

The predicted relationship between behavioral dominance and sexual jealousy did not materialize, nor did the relationship between behavioral and trait dominance. Dominant behavior, as measured by SES, does not appear to mediate the relationship

[42] Like facial dominance, SDO is sexually dimorphic.

between facial dominance and sexual jealousy, nor does it appear that trait dominance mediates the facial dominance-behavioral dominance relationship. Much as was the case in hypothesis 1, this may be due to the nature of the SES measure.

4.1.6 Hypothesis 7

In spite of the support of Hypothesis 2 & 4 (facial dominance positively correlating with trait dominance and sexual jealousy, respectively), Hypothesis 7 did not reveal a positive correlation between trait dominance and sexual jealousy. The relationship in fact was negative. This result may not be altogether surprising given findings by Pratto et al. (1994) showing a lack of a relationship between SDO and interpersonal dominance[43]. Given that finding, there should not be a transitive association between interpersonal dominance and sexual jealousy *(Interpersonal dominance → SDO and SDO → Sexual Jealousy; Interpersonal dominance → Sexual Jealousy*). After all, SDO and the RDQ measure two different constructs: group-based dominance[44] vs. interpersonal dominance. All the same, it would be reasonable to expect some overlap between the two constructs. It is hard to fathom how a person could have a social dominance orientation without being -on some level- interpersonally dominant. The suspicion is corroborated by Altemeyer (1998). He found that SDO and scores on the balanced Personal Power, Meanness, and Dominance scale were positively related. Though this finding contradicts Pratto et al. (1994), it illustrates the point. As was the case in Hypothesis 1, the matter of the measure can impact the result.

[43] As measured by the California Personality Inventory (CPI) & the Jackson Personality research Form (JPRF)
[44] Though SDO is described as a personality variable, it is really an attitude inventory. It asks people what they THINK rather than how they behave, see Ray (2003)

The presence of a relationship between dominance and sexual jealousy may thus be a function of the dominance measure used. SDO seems particularly appropriate in that it accords well with reproductive strategies predicted by parental investment theory (Trivers, 1972). That is men who score high on the SDO scale endorse the reproductive strategies of multiple simultaneous mating, resistance to caring for children as one's own, and sexual jealousy. They also tend to be prolific fathers (Betzig, 1993). This suggests that if one were to investigate the relationship between dominance and sexual jealousy, conceptually SDO might be the more appropriate measure.

4.1.7 Hypothesis 8

To the author's knowledge, the significant positive correlation between height and facial dominance is a novel finding. Novel though it is, the finding fits a larger pattern. Other forms of dominance are also known to correlate with height, e.g., trait dominance (Melamed, 1992), and status (e.g., Egolf & Corder, 1991; Hensley, 1993; Weisfeld & Beresford, 1982). Height and facial dominance further both correlate with evolutionary fitness. Men with these attributes reproduce more successfully (e.g. Mueller & Mazur, 2001; Pawlowski, Dunbar, & Lipowicz, 2000).

As discussed in the introduction, evidence shows that height also involves the action of androgens. Gonadal and adrenal androgens play a role in regulating the rate and growth in height from mid-childhood to late adolescence when human beings reach their adult height (Zemel & Katz, 1986).

4.1.8 Height findings

Directional asymmetry (DA), as mentioned earlier, is simply LH 2D:4D minus RH 2D:4D. Positive values of DA are consistent with a male typical pattern (RH 2D:4D lower than LH 2D:4D) while negative values are male atypical. Benderlioglu and Nelson (2004) found that DA positively correlated with salivary levels of testosterone. The higher the testosterone level the more "right sided" and male typical the 2D:4D lateralization. Androgens appear thus to also underlie directional asymmetry.

The DA-androgen relationship is consistent with the current finding of a positive correlation between facial dominance and directional asymmetry. Testosterone in effect appears to underlie height, DA, 2D:4D, and facial dominance. Not surprisingly all these qualities are sexually dimorphic with men on average reflecting more height, DA, facial dominance, and less 2D:4D than women. So in addition to 2D:4D and facial dominance it appears that height and DA also implicate testosterone pre- and postnatally.

An interesting idea for future research would be to see if the pattern described applied equally to women. Evidence suggests that salivary levels of testosterone in women correlate with masculine sex role identity (Baucom, Besch, & Callahan, 1985). Women with higher levels of testosterone perceived themselves as more action-oriented and self-directed. Further, they had higher scores both on the Baucom's Masculinity scale and the Bem Sex Role Inventory masculinity scale (Bem, 1974). The BSRI is regarded by Wiggins and Holzmuller, (1981) as essentially a dominance scale thus suggesting that androgens in women may underlie a similar set of characteristics.

Preliminary evidence suggests so. Male sex role identity in women is negatively related to 2D:4D (Csatho et al., 2003).

4.1.9 Summary of Findings

Of the hypotheses tested in the present study, only hypotheses 2 & 4 were confirmed. That is, only the qualities of facial dominance & trait dominance, and facial dominance & sexual jealousy correlated as predicted. Three of the unsupported hypotheses involved the SES measure which given its questionable validity may not have not allowed for a good assessment of the hypotheses.

Of the remaining two, hypothesis 3 could not replicate Neave et al's (2003) claim of a negative relationship between 2D:4D and facial dominance. As was discussed, this might have been due to the second order nature of facial dominance development. Unlike 2D:4D, facial dominance requires the added step of pubertal development to express fully. The 2D:4D ratio on the other hand does not. It is set from the 13^{th} week of gestation.

The last hypothesis, i.e. the hypothesized positive relationship between trait dominance and sexual jealousy (Hypothesis #7), was also not confirmed. Given the relationship in men between SDO and sexual jealousy, this may have been due, much as was the case with the hypotheses involving the SES measure, to the measure itself (Ray's Dominance Questionnaire). SDO may thus be the more appropriate measure in this case.

4.1.9.1 Height and the Prenatal Androgen Hypothesis

A prediction derived from the "prenatal androgen hypothesis" or PAH is that behaviors, abilities, and physical characteristics mediated by the action of testosterone, both pre- and post-natally, should be correlated. The height findings lend mixed support to the PAH.

Height was found to correlate with facial dominance and directional asymmetry (DA), all characteristics that bear some relationship to testosterone. Granted, it would have been a more powerful statement to have all the testosterone-dependent qualities in this study correlate but, inasmuch as the absence of such is attributable to methodological and not theoretical concerns, there is purpose and cause for future research.

APPENDIX A

RAY'S DOMINANCE QUESTIONNAIRE

On the following pages, there are questions about your behaviors, preferences, thoughts, and feelings. Please use the rating scale below to describe how accurately each statement describes you. Please read each statement carefully, and then fill in the blank with the number on the scale. If you are not sure about your answer to a question or if the question does not apply to you, then a mark a '2'.

Response Options

1 = Yes

2 = Not sure

3 = No

_____Are you the sort of person who always likes to get their own way?

_____Do you tend to boss people around?

_____Do you dislike having to tell others what to do?

_____If you are told to take charge of some situation, does this make you feel uncomfortable?

_____Would you rather take orders than give them?

_____Do you dislike standing out from the crowd?

_____Do you find it difficult to make up your own mind about things?

_____If anyone is going to be Top Dog, would you rather it be you?

_____Do you tend to dominate the conversation?

_____Do you let your wife (or husband) get their own way most of the time?

_____Are you generally a follower rather than a leader?

_____Would you prefer to be a worker rather than a manager?

_____Do you give in to other people rather easily?

_____Do you tend to be the one who makes the decisions at home?

_____Do other people tend to seek your opinion on things?

_____Do you like to have the last word in an argument or discussion?

_____Do you hate giving speeches or talks in public

(For example: Being asked to say a few words at a wedding)?

_____In an argument or discussion, will you argue for your own point of view even though you are in the minority?

_____Have you ever run for office in any club or organization?

_____Are you a bit of a social organizer?

_____Are you pretty good at getting your own way in most things?

_____Rather than argue, do you sometimes let other people push you around a bit?

_____Does the idea of being a leader rather attract you?

_____Do you tend to feel quite confident on occasions when you are directing the activities of others? (or would you if you had to?).

_____Do you try to get yourself into positions of authority where you can?

_____Do you think you would make a good officer in the Army?

_____Are you often in situations where you can't make up your mind what to do for the best?

_____Are you hopeless at organizing other people?

_____Are you easily swayed by other people's opinions?

_____Do you think you would make a poor military leader?

APPENDIX B

BALANCED INVENTORY OF DESIRABLE RESPONDING

BIDR Version 6 – Form 40

Using the scale below as a guide, write a number beside each statement to indicate how much you agree with it.

1----------2----------3----------4----------5----------6----------7
NOT TRUE SOMEWHAT TRUE VERY TRUE

1. My first impressions of people usually turn out to be right.
2. It would be hard for me to break any of my bad habits.
3. I don't care to know what other people really think of me.
4. I have not always been honest with myself.
5. I always know why I like things.
6. When my emotions are aroused, it biases my thinking.
7. Once I've made up my mind, other people can seldom change my opinion.
8. I am not a safe driver when I exceed the speed limit.
9. I am fully in control of my own fate.
10. It's hard for me to shut off a disturbing thought.
11. I never regret my decisions.
12. I sometimes lose out on things because I can't make up my mind soon enough.
13. The reason I vote is because my vote can make a difference.
14. My parents were not always fair when they punished me.
15. I am a completely rational person.
16. I rarely appreciate criticism.
17. I am very confident of my judgments.
18. I have sometimes doubted my ability as a lover.
19. It's all right with me if some people happen to dislike me.
20. I don't always know the reasons why I do the things I do.
21. I sometimes tell lies if I have to.
22. I never cover up my mistakes.
23. There have been occasions when I have taken advantage of someone.
24. I never swear.
25. I sometimes try to get even rather than forgive and forget.
26. I always obey laws, even if I'm unlikely to get caught.
27. I have said something bad about a friend behind his or her back.
28. When I hear people talking privately, I avoid listening.
29. I have received too much change from a salesperson without telling him or her.
30. I always declare everything at customs.
31. When I was young I sometimes stole things.
32. I have never dropped litter on the street.
33. I sometimes drive faster than the speed limit.
34. I never read sexy books or magazines.
35. I have done things that I don't tell other people about.
36. I never take things that don't belong to me.

37. I have taken sick-leave from work or school even though I wasn't really sick.
38. I have never damaged a library book or store merchandise without reporting it.
39. I have some pretty awful habits.
40. I don't gossip about other people's business.

APPENDIX C

JEALOUSY MEASURE

In the situation described below that there is no danger of sexually transmitted diseases occurring because of the relationship.

Please think of a committed romantic relationship that you have had in the past, that you have now, or that you would like to have. You now suspect that the person with whom you have been seriously involved is spending time with someone else. If your partner is in fact involved with that person, what would upset you more?

(Please check only one option.)

__(A) Your partner trying different sexual positions with that person?

__(B) Your partner falling in love with that person?

__ (A) & (B) upset me equally

OR

In the situation described below that there is no danger of sexually transmitted diseases occurring because of the relationship.

Please think of a committed romantic relationship that you have had in the past, that you have now, or that you would like to have. You now suspect that the person with whom you have been seriously involved is spending time with someone else. If your partner is in fact involved with that person, what would upset you more?

(Please check only one option.)

__(A) Your partner falling in love with that person?

__(B) Your partner trying different sexual positions with that person?

__ (A) & (B) upset me equally

APPENDIX D

DEBRIEFING STATEMENT

This study is not, as described in the informed consent form, about Contrast Sensitivity Ability, but rather about Facial Dominance. Contrast Sensitivity Ability is in fact a fictional construct. This deception was necessary in order to prevent any potential bias in your responses. Deception was also used with regard to your "partner". He was also fictional. This was done so as to control the pattern of "partner" responses you received. The purpose of the study was to explore the association, if any, between facial dominance, behavior, and the ratio of the index to ring fingers. A preliminary finding suggests that low index to ring finger ratios correlate with facial dominance. It is not known however whether such an association extends over to behavior. Facial Dominance by the way is just simply how masculine a face looks. The behavior is called dominant behavior. Dominant behavior is behavior that "attempts to control the environment and to influence or direct other people". If you have any questions about the study or would like to obtain a copy of the first group trend results, you can email us at cab0140@exchange.uta.edu. Thanks for your participation.

REFERENCES

Adams, E. S., & Mestertongibbons, M. (1995). The cost of threat displays and the stability of deceptive communication. *Journal of Theoretical Biology, 175*(4), 405-421.

Altemeyer, B. (1998). The other "authoritarian personality". *Advances in Experimental Social Psychology, Vol 30, 30*, 47-92.

Altemeyer, B. (2004). Highly dominating, highly authoritarian personalities. *Journal of Social Psychology, 144*(4), 421-447.

Baucom, D. H., Besch, P. K., & Callahan, S. (1985). Relation between testosterone concentration, sex role identity, and personality among females. *Journal of Personality and Social Psychology, 48*(5), 1218-1226.

Belhadi, C. A., & Mellgren, R. L. (2004). [Sexual jealousy: A methodological study]. *Unpublished Study.*

Bem, S. L. (1974). The measurement of psychological androgyny. *Journal of Consulting and Clinical Psychology, 42*(2), 155-162.

Benderlioglu, Z., & Nelson, R. J. (2004). Digit length ratios predict reactive aggression in women, but not in men. *Hormones and Behavior, 46*(5), 558-564.

Berger, J., Fisek, M., & Conner, T. (1974). *Expectations state theory*. Cambridge, MA.: Winthrop.

Bergstrom, C. T. (2002). *The theory of honest signaling.* Retrieved 02/08, 2005 from http://octavia.zoology.washington.edu/handicap/handicap_principle.html

Berry, D. S. (1991). Accuracy in social-perception - contributions of facial and vocal information. *Journal of Personality and Social Psychology, 61*(2), 298-307.

Berry, D. S. (1990). Taking people at face value - evidence for the kernel of truth hypothesis. *Social Cognition, 8*(4), 343-361.

Berry, D. S., & Brownlow, S. (1989). Were the physiognomists right - personality-correlates of facial babyishness. *Personality and Social Psychology Bulletin, 15*(2), 266-279.

Betzig, L. (1993). Sex, succession, and stratification in the first six civilizations: How powerful men reproduced, passed on power to their sons, and used power to defend their wealth, women, and children. In L. Ellis (Ed.), *Social stratification and socioeconomic equality: A comparative biosocial analysis* (pp. 37-74). New York: Praeger.

Blair, R. J. R. (2003). Facial expressions, their communicatory functions and neuro-cognitive substrates. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences, 358*(1431), 561-572.

Brown, W. M., Finn, C. J., Cooke, B. M., & Breedlove, S. M. (2002). Differences in finger length ratios between self-identified "butch" and "femme" lesbians. *Archives of Sexual Behavior, 31*(1), 123-127.

Brown, W. M., Hines, M., Fane, B. A., & Breedlove, S. M. (2002). Masculinized finger length patterns in human males and females with congenital adrenal hyperplasia. *Hormones and Behavior, 42*(4), 380-386.

Burgoon, J. K., Buller, D. B., Hale, J. L., & Deturck, M. A. (1984). Relational messages associated with nonverbal behaviors. *Human Communication Research, 10*(3), 351-378.

Burgoon, J. K., Johnson, M. L., & Koch, P. T. (1998). The nature and measurement of interpersonal dominance. *Communication Monographs, 65*(4), 308-335.

Buss, D. M. (2000). *The dangerous passion: Why jealousy is as necessary as love and sex*. New York: The Free Press.

Buss, D. M., Larsen, R. J., Westen, D., & Semmelroth, J. (1992). Sex-differences in jealousy - evolution, physiology, and psychology. *Psychological Science, 3*(4), 251-255.

Cherulnik, P. D., Turns, L. C., & Wilderman, S. K. (1990). Physical appearance and leadership - exploring the role of appearance-based attribution in leader emergence. *Journal of Applied Social Psychology, 20*(18), 1530-1539.

Cherulnik, P. D., Way, J. H., Ames, S., & Hutto, D. B. (1981). Impressions of high and low Machiavellian men. *Journal of Personality, 49*(4), 388-400.

Csatho, A., Osvath, A., Bicsak, E., Karadi, K., Manning, J., & Kallai, J. (2003). Sex role identity related to the ratio of second to fourth digit length in women. *Biological Psychology, 62*(2), 147-156.

Cunningham, M. R., Barbee, A. P., & Pike, C. L. (1990). What do women want - facialmetric assessment of multiple motives in the perception of male facial physical attractiveness. *Journal of Personality and Social Psychology, 59*(1), 61-72.

Daly, M., Wilson, M., & Weghorst, S. J. (1982). Male sexual jealousy. *Ethology and Sociobiology, 3*(1), 11-27.

Dovidio, J. F., & Ellyson, S. L. (1982). Decoding visual dominance - attributions of power based on relative percentages of looking while speaking and looking while listening. *Social Psychology Quarterly, 45*(2), 106-113.

Egolf, D. B., & Corder, L. E. (1991). Height differences of low and high job status, female and male corporate employees. *Sex Roles, 24*(5-6), 365-373.

Feinberg, D. R., Jones, B. C., Smith, M. J. L., Moore, F. R., DeBruine, L. M., & Cornwell, R. E. et al. (2006). Menstrual cycle, trait estrogen level, and masculinity preferences in the human voice. *Hormones and Behavior, 49*(2), 215-222.

Folstad, I., & Karter, A. J. (1992). Parasites, bright males, and the immunocompetence handicap. *American Naturalist, 139*(3), 603-622.

Foschi, M. (1996). Double standards in the evaluation of men and women. *Social Psychology Quarterly, 59*(3), 237-254.

Free Software Foundation, Inc. (2005). *(GIMP) GNU Image Manipulation Program (www.gimp.org)*. Boston, MA.

Gangestad, S. W., & Scheyd, G. J. (2005). The evolution of human physical attractiveness. *Annual Review of Anthropology, 34*, 523-548.

Gaulin, S. J. C., Silverman, I., Phillips, K., & Reiber, C. (1997). Activational hormonal influences on abilities and attitudes: Implications for evolutionary theory. *Evolution and Cognition, 3*, 191-199.

Geary, D. C., DeSoto, M. C., Hoard, M. K., Sheldon, M. S., & Cooper, M. L. (2001). Estrogens and relationship jealousy. *Human Nature-an Interdisciplinary Biosocial Perspective, 12*(4), 299-320.

Grafen, A., & Johnstone, R. A. (1993). Why we need ESS signaling theory. *Philosophical Transactions of the Royal Society of London Series B-Biological Sciences, 340*(1292), 245-250.

Grammer, K., & Thornhill, R. (1994). Human (homo-sapiens) facial attractiveness and sexual selection - the role of symmetry and averageness. *Journal of Comparative Psychology, 108*(3), 233-242.

Gross, T. F. (1997). Children's perception of faces of varied immaturity. *Journal of Experimental Child Psychology, 66*(1), 42-63.

Guilford, T., & Dawkins, M. S. (1995). What are conventional signals. *Animal Behaviour, 49*(6), 1689-1695.

Harris, C. R. (2002). Sexual and romantic jealousy in heterosexual and homosexual adults. *Psychological Science, 13*(1), 7-12.

Harris, C. R. (2003). A review of sex differences in sexual jealousy, including self-report data, psychophysiological responses, interpersonal violence, and morbid jealousy. *Personality and Social Psychology Review, 7*(2), 102-128.

Harris, C. R. (2004). The evolution of jealousy. *American Scientist, 92*(1), 62-71.

Havlicek, J., Roberts, S. C., & Flegr, J. (2005). Women's preference for dominant male odour: Effects of menstrual cycle and relationship status. *Biology Letters, 1*(3), 256-259.

Heaven, P. C. L. (1986). Directiveness and dominance. *Journal of Social Psychology, 126*(2), 271-272.

Hensley, W. E. (1993). Height as a measure of success in academia. *Psychology: A Journal of Human Behavior, 30*(1), 40-46.

Johnstone, R. A. (1995). Sexual selection, honest advertisement and the handicap principle - reviewing the evidence. *Biological Reviews of the Cambridge Philosophical Society, 70*(1), 1-65.

Johnstone, R. A., & Grafen, A. (1993). Dishonesty and the handicap principle. *Animal Behaviour, 46*(4), 759-764.

Johnstone, R. A., & Grafen, A. (1992). Error-prone signaling. *Proceedings of the Royal Society of London Series B-Biological Sciences, 248*(1323), 229-233.

Kalma, A. (1991). Hierarchisation and dominance assessment at 1st glance. *European Journal of Social Psychology, 21*(2), 165-181.

Keating, C. F., & Bai, D. L. (1986). Children's attributions of social-dominance from facial cues. *Child Development, 57*(5), 1269-1276.

Keating, C. F., Mazur, A., & Segall, M. H. (1981). A cross-cultural exploration of physiognomic traits of dominance and happiness. *Ethology and Sociobiology, 2*(1), 41-48.

Keating, C. F., Mazur, A., & Segall, M. H. (1977). Facial gestures which influence perception of status. *Sociometry, 40*(4), 374-378.

Keating, C. F., Mazur, A., Segall, M. H., Cysneiros, P. G., Divale, W. T., & Kilbride, J. E. et al. (1981). Culture and the perception of social-dominance from facial expression. *Journal of Personality and Social Psychology, 40*(4), 615-626.

Koehler, N., Simmons, L. W., & Rhodes, G. (2004). How well does second-to-fourth-digit ratio in hands correlate with other indications of masculinity in males? *Proceedings of the Royal Society of London Series B-Biological Sciences, 271*, S296-S298.

Krill, A. L., & Platek, S.M. (2006). *Do "Good Genes" Predict Forced Copulation? A Test of Whether Facial Symmetry and Masculinity Are Related to Sexual Battery.* Poster session presented at the annual meeting of the Human Behavior and Evolution Society, Philadelphia, PA [Abstract only].

Lamb, T. A. (1981). Nonverbal and paraverbal control in dyads and triads - sex or power differences. *Social Psychology Quarterly, 44*(1), 49-53.

Manning, J. T., Scutt, D., Wilson, J., & Lewis-Jones, D. I. (1998). The ratio of 2nd to 4th digit length: A predictor of sperm numbers and concentrations of testosterone, luteinizing hormone and oestrogen. *Human Reproduction, 13*(11), 3000-3004.

Mast, M. S., & Hall, J. A. (2004). Who is the boss and who is not? Accuracy of judging status. *Journal of Nonverbal Behavior, 28*(3), 145-165.

Mazur, A., & Mueller, U. (1996). Facial dominance. In A. Somit, & S. Peterson (Eds.), *Research in biopolitics* (pp. 99-111). London: JAI Press.

Mazur, A., & Booth, A. (1998). Testosterone and dominance in men. *Behavioral and Brain Sciences, 21*(3), 353-397.

Mazur, A., & Cataldo, M. (1989). Dominance and deference in conversation. *Journal of Social and Biological Structures, 12*(1), 87-99.

Mazur, A., Mazur, J., & Keating, C. (1984). Military rank attainment of a west point class - effects of cadets' physical features. *American Journal of Sociology, 90*(1), 125-150.

Melamed, T. (1992). Personality-correlates of physical height. *Personality and Individual Differences, 13*(12), 1349-1350.

Moller, A. P. (1987). Social-control of deception among status signaling house sparrows passer-domesticus. *Behavioral Ecology and Sociobiology, 20*(5), 307-311.

Montepare, J. M., Zebrowitz L., & M^{c}Arthur, L. (1989). Children's perceptions of baby-faced adults. *Perceptual and Motor Skills, 69*(2), 467-472.

Morris, J. S., Frith, C. D., Perrett, D. I., Rowland, D., Young, A. W., & Calder, A. J. et al. (1996). A differential neural response in the human amygdala to fearful and happy facial expressions. *Nature, 383*(6603), 812-815.

Mueller, U., & Mazur, A. (1997). Facial dominance in homo sapiens as honest signaling of male quality. *Behavioral Ecology, 8*(5), 569-579.

Mueller, U., & Mazur, A. (1996). Facial dominance of west point cadets as a predictor of later military rank. *Social Forces, 74*(3), 823-850.

Neave, N., Laing, S., Fink, B., & Manning, J. T. (2003). Second to fourth digit ratio, testosterone and perceived male dominance. *Proceedings of the Royal Society of London Series B-Biological Sciences, 270*(1529), 2167-2172.

Okten, A., Kalyoncu, M., & Yaris, N. (2002). The ratio of second- and fourth-digit lengths and congenital adrenal hyperplasia due to 21-hydroxylase deficiency. *Early Human Development, 70*(1-2), 47-54.

Paulhus, D. L., & John, O. P. (1998). Egoistic and moralistic biases in self-perception: The interplay of self-deceptive styles with basic traits and motives. *Journal of Personality, 66*(6), 1025-1060.

Pawlowski, B., Dunbar, R. I. M., & Lipowicz, A. (2000). Evolutionary fitness - tall men have more reproductive success. *Nature, 403*(6766), 156-156

Penton-Voak, I. S., & Chen, J. Y. (2004). High salivary testosterone is linked to masculine male facial appearance in humans. *Evolution and Human Behavior, 25*(4), 229-241.

Penton-Voak, I. S., Little, A. C., Jones, B. C., Burt, D. M., Tiddeman, B. P., & Perrett, D. I. (2003). Female condition influences preferences for sexual dimorphism in faces of male humans (homo sapiens). *Journal of Comparative Psychology, 117*(3), 264-271.

Pietrzak, R. H., Laird, J. D., Stevens, D. A., & Thompson, N. S. (2002). Sex differences in human jealousy - A coordinated study of forced-choice, continuous rating-scale, and physiological responses on the same subjects. *Evolution and Human Behavior, 23*(2), 83-94.

Platek, S. M. (2006). *Do "Good Genes" Predict Forced Copulation? A Test of Whether Facial Symmetry and Masculinity are Related to Sexual Battery.* . Retrieved June 25, 2006, from smp43@drexel.edu [Personal Communication]

Posamentier, M. T., & Abdi, H. (2003). Processing faces and facial expressions. *Neuropsychology Review, 13*(3), 113-143.

Pratto, F., & Hegarty, P. (2000). The political psychology of reproductive strategies. *Psychological Science, 11*(1), 57-62.

Pratto, F., Sidanius, J., Stallworth, L. M., & Malle, B. F. (1994). Social-dominance orientation - a personality variable predicting social and political-attitudes. *Journal of Personality and Social Psychology, 67*(4), 741-763.

Ray, J. J. (1981). Authoritarianism, dominance and assertiveness. *Journal of Personality Assessment, 45*(4), 390-397.

Ray, J. J. (2003). *Social dominance orientation: Theory or artifact?* Retrieved 07/11, 2006 from http://jonjayray.netfirms.com/sdo.html

Rilling, J. K., Winslow, J. T., & Kilts, C. D. (2004). The neural correlates of mate competition in dominant male rhesus macaques. *Biological Psychiatry, 56*(5), 364-375.

Rogers, L. E., & Farace, R. V. (1975). Analysis of relational communication in dyads: New measurement procedures. *Human Communication Research, 1*, 222-239

Sidanius, J., & Pratto, F. (2001). *Social dominance: An intergroup theory of social hierarchy and oppression.* New York: Cambridge University Press.

Smith, J. M. (1994). Must reliable signals always be costly. *Animal Behaviour, 47*(5), 1115-1120.

Swaddle, J. P., & Reierson, G. W. (2002). Testosterone increases perceived dominance but not attractiveness in human males. *Proceedings of the Royal Society of London Series B-Biological Sciences, 269*(1507), 2285-2289

Thornhill, R., & Gangestad, S. W. (1996). The evolution of human sexuality. *Trends in Ecology & Evolution, 11*(2), A98-A102.

Trivers, R. L. (1972). Parental investment and sexual selection. In B. Campbell (Ed.), *Sexual selection and the descent of man* (pp. 136-179). Chicago: Aldine.

Troyer, L. (2002). *WinSES, v.7.2. Unpublished Software Manual*

Weisfeld, G. E., & Beresford, J. M. (1982). Erectness of posture as an indicator of dominance or success in humans. [Posture]. *Motivation and Emotion, 6*(2), 113-131. Retrieved 5/19/2004.

Wiggins, J. S., & Holzmuller, A. (1981). Further evidence on androgyny and interpersonal flexibility. *Journal of Research in Personality, 15*(1), 67-80.

Wilson, M. I., & Daly, M. (1996). Male sexual proprietariness and violence against wives. *Current Directions in Psychological Science, 5*(1), 2-7.

Winkler, E. M., & Kirchengast, S. (1994). Body dimensions and differential fertility in Kung san males from Namibia. *American Journal of Human Biology, 6*(2), 203-213.

Zemel, B. S., & Katz, S. H. (1986). The contribution of adrenal and gonadal androgens to the growth in height of adolescent males. *American Journal of Physical Anthropology, 71*(4), 459-466.

BIOGRAPHICAL INFORMATION

Chawki A. Belhadi received a B.S. Psychology & Biology in 1993 and an M.S. in Psychology in 2006 from the University of Texas at Arlington. Research interests are in the field of evolution and human behavior. Plans are to pursue a PhD is said field.